UNIVERSITY OF GONDAR
FACULTY OF VETERINARY MEDICINE

PREVALENCE OF COCCIDIOSIS IN CALVES IN AND AROUND DEBEREBRHAN TOWN

DVM THESIS

BY
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A thesis submitted to the Faculty of Veterinary Medicine, University of Gondar in partial fulfillment of the requirements for the degree of Doctor of Veterinary Medici

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%	Percent
A.S.L	Above sea level
D	Desired
Df	Degree of freedom
E	East
Kg	Kilogram
Km	Kilometre
M	Meter
Mg	Milligram
N	North
^{O}C	Degree centigrade
P_{exp}	Prevalence expected
SPSS	Statistical package for social science

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ABSTRACT

Cross-sectional study was conducted from November 2014 up to March 2015 to determine the Prevalence and to assess the risk factors of calf coccidiosis in and around Deberebrhan town. Faecal samples were collected from a total of 384 calves with less than 24 months of age and examined for the oocysts of coccidia. Detailed information of the age, sex, breed, management system, hygienic status and faecal consistency were taken in consideration. Centrifugal faecal floatation technique using salt solution was used to detect coccidian oocyst. The current study has revealed that Out of all 384 samples a total of 104 samples (27.1**%**) were positive for coccidiosis. Coccidian oocysts were detected in calves from birth up to 2 years of age but greater prevalence was observed in age categories less than 6 months of age. Statistically significant association ($p<0.05$) between prevalence of coccidiosis and age, breed faecal consistency, hygienic status and management system was observed in this study. With regard to sex, the prevalence in female calves (29.3%) was a bit higher than males (23.9%). However, the difference was not statistically significant ($P>0.05$) between the sexes. Sex of calves was not found as risk factor influnceing the preavalence of coccidiosis.This study shows that coccidiosis was prevalent in and around Deberebrhan which signifies coccidian infection has a great significance for the livestock producer. So, it needs awareness creation, a serious treatment, control and preventive programs.

Key words: Debereberhan, Centrifugal faecal floatation, Coccidiosis, Oocyst, Prevalen

1. INTRODUCTION

Parasitic diseases are a major constraint in animal health and production throughout the tropic and sub-tropical countries of the world (Juyal and Single, 2011). Bovine coccidiosis is caused by different species of Apicomplexan parasite from the genus Eimeria (Almeida *et al*., 2011). Coccidiosis is responsible for major economic losses in animal husbandry worldwide (Nisarkhan *et al*., 2013). Adult animals are usually asymptomatic carriers that often serve as a source of infection for juvenile animals which are more susceptible to infection (Faber *et al*., 2002; Abebe *et al*., 2008).Coccidiosis is commonly a self limiting disease; and the most signs of bovine coccidiosis is chronic or subclinical (Nalbantoglu *et al*., 2008). The clinical picture of coccidiosis depends on the innate pathogenecity of different Eimeria species. Twelve Eimeria spp have been identified in cattle, worldwide. *E. zurnii* and *E. bovis* are known to be highly pathogenic, causing morbidity and even mortality associated with diarrhea, mucus and blood stains. The other species have been shown experimentally to be mildly or moderately pathogenic, but are not considered important pathogens (Lucas *et al*., 2006).

Coccidian parasites are generally host-specific parasites, and very specific to a particular region in the intestines (Leite, 2009). Many studies indicated that under natural conditions, mixed species infections are much more common than mono species infection. Coccidiosis occur most commonly in animals housed or confined in small areas contaminated with oocysts (Radostitis *et al.,* 2007) and is usually most common and important in calves younger than 1 year (Abebe *et al*., 2008).

Coccidiosis is mainly asymptomatic, but may manifest as heavy diarrhoea sometimes containing blood, fibrin, and intestinal material. Clinical cases can vary from some loss of appetite and decrease in weight gain and slight, short lived diarrhoea to severe cases involving great amounts of dark, bloody and foul smelling diarrhoea, fluid faeces containing mucous and blood, persistent straining in attempt to pass faeces, loss of weight, rough hair coat, dehydration, and in some cases death (Radostitis *et al.,* 2007). Clinical disease is most prevalent where animals are subjected to overcrowding, unhygienic environments, or when animals are stressed. Economic loss in clinical disease is mostly attributed to mortality, poor performance, and the costs of treatment and prevention and although subclinically infected animals may appear normal, they may have reduced feed consumption, feed conversion and growth performance (Vorster and Mapham, 2012). Climatic factors, age of the host, as well as

management determine the pattern of presentation of coccidiosis in different regions (Rodriguez-Vivas *et al*., 1996).

In Ethiopia a few studies are conducted in calves by Abebe *et al.*, in (2008), Alemayehu *et al.*, (2013) and Mihreteab *et al.*, (2012) and also in poultry by Diriba *et al., (*2012) and other which show the presence of coccidiosis in the country. But no study has been carried in and around in Debereberhan town to determine the presence of the disease in the area. In general, adequate data on the distribution of calf coccidiosis is lacking.

Therefore the objectives of the study are:

- To estimate the prevalence of coccidiosis in calves
- To identify risk factors associated with coccidiosis infection.

2. LITERATURE REVIEW

2.1. Coccidiosis

Bovine coccidiosis is an important protozoan disease of genus Eimeria affecting calves all over the world resulting in considerable economic losses each year to beef and dairy industries (Mihreteab *et al*.,2012). Clinically it is characterized by enteritis, although subclinical infections are frequent (Pence, 2011). All age groups of cattle are susceptible to infection, but clinical case is most common in young animals (Nagwa *et al.*, 2011).

2.2. Etiology

More than thirteen different species of Eimeria affect cattle and all are intracellular protozoal parasites affecting cells lining the intestinal tract (Hendrex, 1998; Taylor, 2007). Of these, 5 species, *E. bovis, E zuernii, E. auburnensis, E. ellipsoidalis*, and *E. alabamensis*, are considered pathogenic (Dubey *et al.*, 2008) and the most important of this genus for causing disease in cattle are *Eimeria bovis* and *Eimeria zuernii* (Maas, 2007).

2.3. Epidemiology

Coccidiosis is mostly a disease of young animals less than one year of age (Ernst *et al*., 1987) raised and kept under intensive management systems although older animals may occasionally be clinically affected. Disease usually occurs when the resistance of the host is lowered following stress, overcrowding, weaning, transportation, housing under conditions of poor hygiene, food changes, nutritional deficiencies, concomitant infections with other parasitic/infectious agents and adverse weather conditions. High temperatures and humidity encountered in overstocked feedlots, pens containing straw bedding, or in kraals and irrigated pastures, are favourable for the survival of oocysts and therefore higher infection rates compared to extensive farming systems. Sporulated oocysts are very resistant to adverse environmental conditions and may survive on the pastures until climatic conditions become favourable (Vorster and Mapham, 2012). Oocyst do not survive well at temperature below -30^{o}c or above 40^{o}c; within this range, they may survive up to one year or more (Merck, 2005).

2.4. Risk factor

Factors which predispose to an outbreak of coccidiosis include: age which is usually important in calves or weaners (which have no immunity), stress due to weaning, cold weather or inappropriate weaning diets, weaning light-weight calves, confinement in small areas such as yards or small paddocks and feeding on the ground or in troughs which can be contaminated by faces (also applies to water troughs) (Fitzpatrick, 2006).

2.5. Method of transmission

Coccidiosis is transmitted from animal to animal by the faecal oral route. Infected faecal material contaminating feed, water, or soil serves as carrier of the oocyst; therefore, the susceptible animal contracts the disease by eating and drinking, or by licking itself. Oocysts passed in the faeces require suitable environmental condition to sporulate (Radostitis *et al.*, 2007).

2.6. Life cycle

Coccidia have a complex life cycle, with several generations included in a single cycle. (Ernst *et al*., 1987). Bovine coccidia develop both within the host animal as well as outside (Kennedy, 2011). The life cycle of coccidia is complex with both sexual and asexual stages in the intestines of cattle (see figure 1) which is divided in to three phases: sporulation, infection and merogony (schizogony) and finally gametogony (Taylor *et al.,* 2007). Cattle ingest the infective oocyst liberating an infective form called sporozoite. This form penetrates the cells of the intestine, and goes through a cycle of rapid growth and reproduction known as the asexual phase. One infective oocyst can produce up to 900 asexual forms, each invading a cell in the intestine. The asexual phase is repeated several times during a 21 to 28 day cycle. Eventually the asexual form becomes a precursor of a sex cell that results in an oocyst that is passed in the faeces (Pence, 2011).

Coccidia harm the host by destroying the cells and tissues in the lower part of intestines, cecum and the colon. The loss of intestinal lining may lead to blood and fluid loss and may alter food absorption. Secondary bacterial invasion of the intestine may follow. Coccidian are extremely prolific, one

ingested oocyst is capable of producing 27, 648, 000 oocysts destroying an equal number of intestinal cells (Pence, 2011).

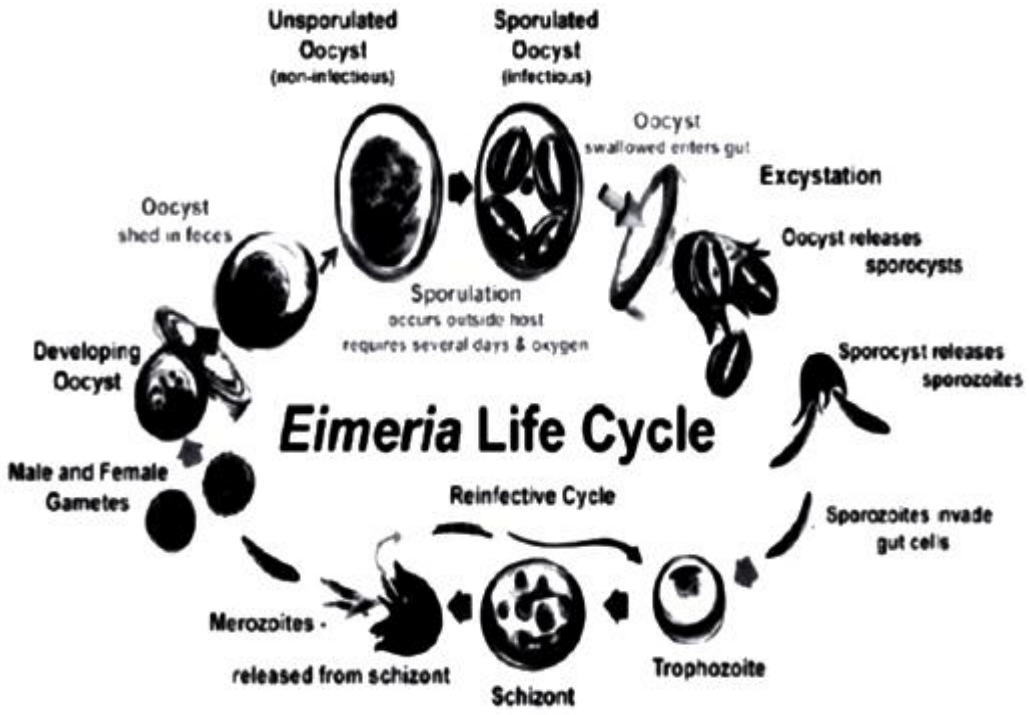

Figure 1. Life cycle of Eimeria species

Source: Lassen, 2009

When a sporulated oocyst enters the gut intestinal grinding of the gizzard and enzymes release the 8 sporozoites encapsulated in the 4 sporocysts. The asexual reproduction (schizogony) is repeated several times inside the invaded intestinal lining, followed by a sexual phase where penetrating merozoites form gametes (gametogony). A microgamete and macrogamete fuse and develop into unsporulated oocysts that leave with the faeces. Outside the animal the oocyst sporulate into its infective form (Lassen, 2009).

2.7. Pathogenesis

The most pathogenic species of coccidia are those that infect and destroy the crypt cells of the large intestine mucosa. This is because the ruminant small intestine is very long, providing a large number of host cells and the potential for enormous parasite replication with minimal damage (Taylor, 2007) The coccidian of domestic animals pass through all stages of their life cycle in the alimentary mucosa and do not invade other organs, although schizonts have been found in the mesenteric lymph nodes of sheep and goats. The different species of coccidian localize in different part of the intestine. *E. zuernii* and *E. bovis* occur primarily in the cecum, colon and the distal ileum, whereas *E. ellipsoidalis* and *E. arloingi* affect the small intestine. *E. gilruthi* localizes in the abomasum and occasionally the duodenum (Radostitis *et al.*, 2007).

The severity of disease depends on the number of oocysts ingested. The more oocysts ingested, the more severe the disease (Kirkpatrick and Selk, 2011). The major damage is due to the rapid multiplication of the parasite in the intestinal wall, and the subsequent rupture of the cells of the intestinal lining. Several stages of multiplication occur before the final stage, the oocyst, is passed in the faeces (Stokka, 1996).

2.8. Clinical sign

Clinical coccidiosis in cattle mainly depends on factors like species of Eimeria, age of infected animal, number of oocysts ingested, presence of concurrent infections, and type of production system and management practice. Compared to clinical coccidiosis, subclinical coccidiosis is economically more important and may account for over 95% of all the losses associated with coccidiosis (Nagwa *et al.*, 2011).Cattle infected by a few oocysts are only mildly affected. Under crowded conditions large numbers of oocysts are ingested causing severe or fatal infection, particularly in calves (Kennedy, 2011).

The incubation period can be between 16-30 days. Common signs of the coccidiosis are: loss of appetite, weight loss, diarrhoea, dysentery (passing blood stained faces), tensmus (straining to defecate), (Veterinary Laboratory Agency, 2009 & Kaufman, 1996), rough hair coat, dramatic drop in milk production, dehydration and death sometimes 2-4 days preceded by convulsion (Schipper, 2000).

Cattle that recover from coccidiosis usually become immune to later infections, but they may continue to pass oocysts in the manure, thereby providing a source of infection for susceptible calves (kennedy, 2001).

2.9. Diagnosis

Diagnosis is made from a combination of herd history, clinical signs, physical examination of the animal and microscopic examination of manure taken from the rectum (Kennedy, 2001). Interpretation of faecal examinations is not simple because there are low numbers of oocysts present in the faeces of many normal calves. The stage of infestation also greatly influences the number of oocysts present in faeces. So, the demonstration of large numbers oocysts in faecal samples is helpful but speciation to determine whether they are pathogenic (capable of causing disease) is rarely undertaken in field outbreaks. Histopathological finding of coccidiosis in the gut of a dead calf confirms the clinical diagnosis (Scott, 2011). Diarrhoea usually precedes heavy oocyst discharge by one or two days but may continue after oocyst discharge has returned to low levels (Kennedy, 2001).

2.10. Treatment

Agents are either coccidiocidal (cidal), which means they kill the parasite, or coccidiostatic (static), which do not kill the parasites, but arrest their development. With coccidiostatic treatment, the live parasites will still be present in the calf's intestines (Pertfied, 2010).

A major difficulty in treating clinical coccidiosis is that signs of the disease do not appear until the life cycle is almost complete. By this time, the gut may be severely damaged. Most anticoccidial drugs are only effective during early stages of a coccidian life cycle. Thus, the difficulty in treating coccidiosis is that by the time signs appear, parasites have already passed through the stage in which anticoccidial drugs are most effective. Infected animals often recover without treatment due to acquired resistance to the disease. However, treatment with anticoccidial drugs should be administered at the earliest clinical signs because it may reduce severity of the disease and decrease mortality. Antibiotics may be administered to reduce secondary infections. Electrolyte solutions and fluids should be administered to control dehydration. During treatment, animals should be isolated in a clean environment to prevent further contamination. Treatments for coccidiosis include sulfonamides in the drinking water and amprolium in the feed. Polyether antibiotics, such as lasalocid and monensin, originally developed as coccidiostats for poultry, have been effective in preventing coccidiosis in cattle (Quigley, 2001).

The approved drugs for prevention of coccidiosis in cattle are Rumensin, Amprolium, Deccox, and Bovatec. Amprolium is a coccidiostat used as a feed additive or in the drinking water and is best used as a treatment of clinically infected cattle. It is administered continuously for 21 days. It is well tolerated and must be withdrawn at least 24 hours before processing cattle. It can also be used as treatment to reduce the effects of an acute outbreak. The clinically affected animals should be treated with sulfa drugs, and then the coexistent cattle should receive Amprolium or Deccox to prevent further cycling of the oocysts. The medication should be fed for 28 to 56 days or longer. All incoming cattle should be given some type of preventative treatment for at least 28 days to prevent coccidiosis. Rumensin and Bovetec are growth promoting feed additives that are also effective at preventing coccidiosis. These products should be used only to prevent subclinical and clinical coccidiosis and not for treatment (Pence, 2011).

2.11. Control and prevention

The most acceptable method of control is prevention achieved by timely medication (Pence, 2011). Limit faecal to oral transmission of the coccidiosis parasite through environmental management, minimizing exposure of animals to faecal contaminated feed, water, and soil, routinely clean maternity pens for early prevention. Minimize contact between calves, people in contact with calves should routinely wash boots, clothing, prevent overgrazing of pastures, and isolation of animals with severe clinical signs (severe diarrhoea, dehydration). Include Rumensin in the calf starter to prevent coccidiosis “breaks” (Perfield, 2010). The approved drugs for prevention of coccidiosis in cattle are Rumensin, Amprolium, Deccox, and Bovatec. Deccox is a feed additive that is effectively used as a preventative treatment in confined cattle (Pence, 2011).

Vaccination for control of bovine coccidiosis is currently not practical although research into the development and testing of vaccines is ongoing. In contrast far more attention seems to be given to the production of vaccines in the poultry industry and multiple articles have been published on this subject (Vorster and Mapham, 2012).

3. MATERIALS AND METHODS

3.1. Study area

Deberebrhan, is a town of North shewa administrative zone of Amhara national regional state situated at 130 km northeast of Addis Ababa. The town Debrebrhan geographically located at lat. 09^0 $31^/$ N and long 39^0 $28^/$ E with an altitude of 2780m a.s.l.

The climatic condition is characterized by the presence of biannual rainfall (short and long) and the dry season which is relatively cool temperature. The rainy season of this area extends from February to April, June to September while the dry season extends from November to January. The mean annual temperature of Deberebrhan is 12.9 where the minimum and maximum temperature is 6.1^0c and 19.9^0c respectively. The average annual rain fall is 905.4mm and relative humidity is 62.3%. The minimum (1.7^0c) and maximum (21.6^0c) temperature are registered in November and July respectively. In the literature the minimum temperature about 10^0c and maximum temperature below 30^0c are favourable parasite development and egg hatching. The livestock population in the area comprises of cattle (2984), goat (115), sheep (5912), horse (520) and poultry (5190) (Zerihune, 2006).

3.2. Study animals

The study was conducted on calves younger than 24 months age by dividing in to three groups: Birth up to 6 months, 6-12 months and 12-24 months which were determined by asking the owner of the animal orally (Mihreteab *et al.*, 2012). This range of age was selected because the disease is more common in young animal. Epidemiological information with respect to their age, sex, breed, faecal consistency (normal, soft and diarrheic), management system, and date of sample collection, hygienic states (house and animal) and kebele or name of the farm was collected. Simple random sampling was used to select the study animals from farms and from small holder. Hygienic status of calf pens and the calves themselves were assessed based on housing system (ventilation, stocking and sanitation) and body parts of the calves and was conveniently categorized as poor and good (Mihreteab *et al*., 2012).

3.3. Sample size determination

Simple random sampling method was used to select the calves from target population. Since there was no similar work done in the area previously, expected prevalence was taken as 50% and the confidence interval chosen as 95% and precision 5%. By substituting these values in the formula, the sample size founded to be 384. Thus, the sample size is calculated according to Thrusfield, (2007) as follows:

$$n = \frac{1.962\ pexp\ (1-pexp)}{d^2}$$

Where, n=required sample size

Pexp =expected prevalence

d=absolute precision (usually 0.05)

3.4. Data collection

A total of 384 faecal samples was collected during the entire period of the study, directly from the rectum of selected calves using a gloved hand and placed into air tight sample vials and transported to Basonaworena vet clinic laboratory, Deberbirhan agricultural research centre laboratory, victory college laboratory and sheep farm laboratory on the same day of collection, and preserved at refrigeration temperature until processing within 48 hours. During sampling, data with regard to age, sex, breed, faecal consistency, and management system, date of sample collection, hygienic states (house and animal) and kebele or name of the farm was recorded for each sampled animal. Faecal sample was qualitatively examined by centrifugation flotation technique. Salt solution was used as a flotation fluid for examination of oocyst under microscope.

3.5. Study design

A cross-sectional study was conducted from october 2014 to March 2015 in and around Deberebrhan. Active data was generated from randomly selected calves with regard to age, breed, sex faecal consistency, management system, and hygienic states (house and animal) was considered as risk factors to test for occurrence of coccidiosis.

3.6. Data management and analysis

Data collected from study sites were coded and entered in to a Microsoft excel spread sheet program for analysis. Statistical analysis was done on Statistical Package for Social sciences (SPSS) software version 16. Descriptive statistics like percentage was used to express prevalence while chi-square ($\chi 2$) test was used to compare the association of coccidiosis with different risk factors. In all the cases, 95% confidence level and 0.05 absolute precision errors were considered. A p-value ≤ 0.05 was considered statistically significant.

4. RESULT

The current study has revealed that out of all the 384 animals examined 104 (27.1%) have tested positive for Eimeria species oocysts as shown in Table 1.

4.1. Prevalence of coccidiosis in calves in relation to host factors

Analysis of the potential host related risk factors for the occurrence of coccidiosis has revealed that there were significant associations ($P<0.05$) with age, fecal consistency and breed of the calves. Even though coccidian oocysts were detected on all age groups of calves, all fecal consistency categories and in both local and cross bred calves, the highest prevalence was recorded in those calves found in the range from one to sixth month of age(51.5%), in calves with diarrheic faecal consistency(71.2%) and in cross breed calves (36.2%). The lowest prevalence was observed in the age group 12-24 months, in normal faecal consistency, and in local breed calves. With regards to sex, the prevalence in female calves (29.3%) was a bit higher than males (23.9%). However, the difference was not statistically significant ($P>0.05$) between the sexes (Table 1).

Table1. Prevalence of coccidiosis in calve in relation to host factors

Risk factor	Number of calves examined	Number of positive cases	Prevalence (%)	Df	χ^2	P-Value
Sex						
Female	229	67	29.3	1	1.358	0.244
Male	155	37	23.9			
Total	384	104	27.1			
Age						
<6 Months	171	88	51.5	2	92.778	0.000
[6-12) Months	118	9	7.6			
[12-24] Month	95	7	7.4			
Total	384	104	27.1			
Breed						
Local	294	70	24.1	1	5.204	0.023
Cross	94	34	36.2			
Total	384	104	27.1			
Fecal consistency						
Normal	247	24	9.7	2	1.1432	0.000
Soft	78	38	48.7			
Diarrheic	59	42	71.2			
Total	384	104	27.1			

Df=Degree of freedom, χ^2=Pearson's Chi-square

4.2. Prevalence of coccidiosis in calve in relation hygienic status and management system

The assessment of hygiene of the calves and management conditions in which they are kept has revealed that there was a statistically significant association (P<0.05) between prevalence of coccidiosis and the hygienic status of the calves. Accordingly, calves with poor hygienic condition showed significantly higher prevalence than calves which have relatively better hygienic condition. There was also a statistically significant association (P<0.05) between prevalence of coccidiosis and the management system. There was higher prevalence of coccidiosis on calves under intensive management system than those calves on semi intensive and extensive systems. The lowest prevalence was observed on calves belonging to the extensive management system (Table 2).

Table2. Prevalence of coccidiosis in calve in relation hygienic status and management system

Risk factor	Number of calves examined	Number of positive case	Prevalence %	Df	χ^2	P-Value
Hygienic status						
Good	283	47	16.6	1	59.789	0.000
Poor	101	57	56.4			
Total	384	104	27.1			
Management system						
Extensive	191	31	16.2	2	29.091	0.000
Semi-intensive	123	39	31.7			
Intensive	70	34	48.6			
Total	384	104	27.1			

Df=Degree of freedom, χ^2=Chi-square

5. DISCUSSION

Coccidiosis is a common problem in cattle worldwide (Davoudi *et al*. 2011). Studies elsewhere have shown prevalences rates ranging between 8% to 100% (Bangoura *et al.*, 2012). Accordingly, research performed across different countries including Ethiopia has revealed a varying prevalence rates of Eimeria spp. In Ethiopia, different researchers have reported varying reports; 22.7% (Abebe *et al*., 2008), 31.9% (Alemayehu *et al.*, 2013) 68% (Dawid *et al*., 2012). The same varying scenarios has been documented elsewhere; 22.6%(Almeida *et al*., 2011) and 33.3% (Poscoti-Bruhn *et al*., 2011) both in Brazil; 47.09% in Pakistan by Muhammad *et al.,* (2010), 82.28% in the coastal plain area of Georgia (USA) by Ernst *et al*., (1987), and 87.8% in the sub-humid tropical climate of Yucatan state in Mexico (Rodriguez-Vivas *et al*., 1996).

In this study the overall prevalence of coccidiosis based on coprological examination was 27.1% and this study was in line with other reports like the prevalence study of bovine coccidiosis in Kombolcha which is 31.9% (Alemayehu *et.al.*,2013) , 22.6% and 33.3% in Brazil (Almeida *et al*., 2011; Poscoti-Bruhn *et al.*, 2011) and 22.7% % in Ethiopia (Abebe *et al*., 2008). However, the current infection rate (27.1%) was lower than that reported in other investigations; in Addis Ababa and Debre Zeit by Abebe *et al*., (2008) (68.1%), in Pakistan by Muhammad *et al.,* (2010) (47.09%), in the coastal plain area of Georgia (USA) by Ernst *et al*., (1987) (82.28%) and in the sub-humid tropical climate Yucatan state of Mexico by Rodriguez-Vivas *et al*., (1996) (87.8%). This variation is most likely attributed to the differences in agro-ecology, management types and husbandry practices of the study animals in different areas (Radostits *et al*., 2006). In addition, those reports with higher prevalence are from areas where intensive management system is practiced more, and it is known that intensive management has more close contact and favours easy faecal-oral contamination from infected to non-infected calves, especially in farms with poor hygienic conditions. Eimeriosis in cattle is particularly a problem of confined animals and the disease is more common in housed animals than in those on pastures. Fecal contamination of feed and water are important factors for the transmission of the infection. Furthermore factors like poor sanitation, and overcrowding can increase level of infection and incidence of the disease due to stress-induced immunosuppression (Taylor *et al*., 2007, Abebe *et al*., 2008, Ur Rehman *et al*., 2011).

There is also differences in number of ingested oocysts, the presence of a concurrent microbial infection, and the functional level of protective immunity may be decisive in whether clinical disease occurs or not (Parker and Jones 1987; Warui *et al*., 2000).

In this observation sex of the calves was not significantly associated (P>0.05) with the risk of infection by coccidiosis. Absence of statistically significant difference between the sexes of the study animals might suggest equal likelihood of being infected with coccidiosis. This is due to either equal chance of accessing the oocysts or no difference on protective immunity for the disease. This finding agrees with the report of Abebe *et al*., (2008) and (Alemayehu *et al*., 2013).Yet, a bit higher prevalence in male calves could be due to the less care given to the male calves as compared to the female calves that are deemed to be future cows. Despite this, previous studies done on adult cattle reported higher prevalence of Eimeria in female animals than in males (Priti *et al*., 2008). Nevertheless, this could be attributed to the physiological stress loaded on female animals in relation to pregnancies and giving birth as compared to males (Curt and Gooch, 2005).

Age of the calves was significantly associated (P<0.05) with the risk of infection by coccidiosis and the highest prevalence was recorded in those calves with youngest age groups (1 to 6months)., this observation in the current study was in line with Dennis *et al.*, (2012), Perfield, (2010) and Mihreteab *et al.*, (2012) who noted that young animal less than 6 months were more susceptible than adults. This is due to stress factors like weaning and change of diet can increase level of infection and incidence of the disease due to stress-induced immune suppression (Kaufman, 1996; Radostitis *et al.*, 2007). In addition to this, coccidiosis is a self-limiting disease in adult and spontaneous recovery without specific treatment is common when the multiplication stage of the coccidian has passed (Radostitis *et al*, 2007). Based on this, previous exposure might have a contribution to the development of certain level of immunity of older calves as compared to younger that did not experience previous exposure. While the presence of immature immune system increases the susceptibility of younger calves (Chibuanda *et al.*, 1997; Paul, 2000; Faber *et al.*, 2002). The results of this study is in contrast to Abebe *et al.*, (2008) who reported that risk of infection by Eimeria species appeared to increase with the age of the examined calves. The investigators have explained that there was good nursing of the colostrum feeding for younger calves which protected the younger from being infected.

There was statistically significant association (P<0.05) between breed and rate of coccidia infection. The highest prevalence was recorded in those calves with cross breed groups than local breed. This is due to either the chance of accessing more oocysts or difference on protective immunity for the disease. This finding disagrees with the report of Abebe *et al*. (2008) and Alemayehu *et al.*, (2013).
There was statistically significant (P<0.05) difference in prevalence rate of coccidian infection and faecal consistency which agrees with the finding of Mihreteab *et al.*, (2012). There was higher prevalence of the disease in diarrhoea faecal consistency than normal faecal consistency. This is due to the major damage in the intestinal wall, and the subsequent rupture of the cells of the intestinal lining and the intestine is unable to absorb nutrient and fluid as a result it released in the form of diarrhoea. However, this finding disagrees with the report of Abebe *et al*., (2008). This might be due to the cause of diarrhoea is another GIT parasite or other infectious agents like bacteria and viruses rather than coccidian in their investigation.

The influence of management system from this study also shows the presence of significant association between prevalence of coccidian infection and different management system which is in agreement with Kennedy and Kralka (1987), but disagrees with the work of Alemayehu who studied on the prevalence of bovine coccidiosis in Kombolcha. Based on their finding, absence of significant difference between intensive and extensive farming systems might be due to presence of good management system in selected animals which belong to intensive management system in Kombolcha (Alemayehu *et al.*, 2013). Coccidiosis is mostly a disease of young animals kept under intensive management systems when there is stress, overcrowding, housing under conditions of poor hygiene, food changes, nutritional deficiencies, and adverse weather conditions which are favourable for the survival of oocysts and therefore higher infection rates when compared to extensive farming systems (Vorster and Mapham, 2012). In this study high prevalence of the disease was observed in intensive management system which is in line with Vorster and Mapham (2012). In this study, the prevalence was low in extensive management system compared to other management system. This might be due to less chance of getting the oocyst in relation to the area they are grazing as there is large grazing roaming area available in extensive management system as compared to intensive management system. In addition there is relatively less degree of stressful condition (in relation to overcrowding and ventilation) as compared to intensive system where overcrowding and confinement can result in stress induced immunosuppression. On other hand, continuous exposure to low numbers of oocysts

which is often the case under field conditions results in endemic stability (Daugschies and Najdrowski, 2005) which makes them relatively resistant than housed animals.

The strong association of the infection with coccidiosis in relation to the hygienic status of calve has been demonstrated in this study. This observation agrees with Mihreteab *et.al.*,(2012). Calves with poor hygiene showed significantly higher prevalence than calves which have relatively better hygiene. This could imply that poor sanitation in calve housing areas as well as poor management of housing favours infection with coccidiosis. Obviously, poor ventilation, heavy stocking, cows present with calves, and soiled bedding were regarded as risk factors for coccidiosis (Daugschies and Najdrowski 2005; Radostitis *et al.*, 2007; Vorster and Mapham, 2012).

6. CONCLUSION AND RECOMMENDATIONS

This study has revealed that the prevalence of calves Eimeria infection in and around Deberebrhan was 27.1%. The prevalence of coccidiosis has no significant association with sex of animals examined during the study period. However, the disease has a significant association ($P<0.05$) with age, breed management system, hygienic status and faecal consistency. This means age, breed management system, hygienic status and faecal consistency of calves were the major risk factors for the prevalence of coccidiosis in and around Deberebrhan town. Even if coccidian oocyst was detected on all age groups the highest prevalence was recorded in those calves found in the range from one to sixth month of age and the lowest prevalence was observed in the age group >12-24 month of age. In this study high prevalence of the disease was observed in cross breed than local breed. Calves with poor hygiene are more susceptible than calves which have relatively better hygiene. Calves with diarrheic faecal consistency are more likely to be affected by coccidiosis than calves which have soft and normal faecal consistency. The lowest prevalence was recorded on calves with normal faecal consistency. In this study high prevalence of the eimeria infection was observed in intensive management system. In general, Eimeria infection causes production and economic loss as well as stress on the animal. It has a great significance for the livestock producer in and around Deberebrhan town and it needs a serious control and prevention programs.

Based on the above conclusion, the following recommendations are forwarded:

- Calves should get colostrum in the first 24 hrs of their life to ensure their immune status in general to prevent the occurrence of concurrent infection that predispose to coccidiosis.
- Stressful conditions like overcrowding and transportation which triggers the disease occurrences should be avoided.
- There should be isolation and treatment of sick animals to prevent further transmission of the disease.
- All measures that minimize the amount of fecal contamination of hair coats should be practiced regularly
- Feed and water troughs should be high enough to avoid heavy fecal contamination.
- There should be creation of awareness for live stock producer about the hygiene of the environment.

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8. ANNEXES

Annex1. Laboratory procedure

Faecal samples were processed using floatation method according to the procedure described in Hansen and Perry, 1994. The procedure in brief is:

(i) 3grams of faecal sample was suspended in 20-50 ml of water. The mixture then strained through a metallic sieve in to centrifuge test tube.

(ii) The mixture was centrifuged to sediment at 2000 revolution per minutes for 2 minutes.

(iii) The supernatant fluid was discarded.

(iv) Floatation fluid was added into the test tube until slight convex meniscus formed at the top.

(v) Then cover slip was placed on the top of the tube, making sure no air bubbles were present and allowed to stand for 10 minutes.

(vi) The cover slip was remove and placed on the slide and examined under the microscope starting with lower magnification power (4 xs and 10 xs).

Source: (Hansen and Perry, 1994)

Annex 2. Data collection sheet

No.	Sex	Age	Breed	Faecal consistency	Hygienic status	Management system	result
1	Female	Birth up-6 moth	Local	Normal	Good	Semi-intensive	+ve
2	Male	>6-12	Cross	Soft	Poor	Intensive	_ve
3		>12-24		Diarric		Extensive	
4							
5							
6							
7							

9. DECLARATION

I, the under signed, declare that the information presented here in my thesis is my original work, has not been presented for degree in any other university and that all sources of materials used for the thesis has been duly acknowledged.

Name: Girma Emiy
Signature**:……**
Data of submission:

This thesis has been submitted for examination with my approval as university advisor

Name: Elias kebede (DVM, MSc)

Signature:**…….**